

WHAT IS CLAIMED IS:

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1. A pulse detonation wave engine detonation system comprising:
a plurality of detonation banks, each detonation bank having a plurality of
detonation chambers for receiving a fuel/oxidizer mixture from a fuel/oxidizer
source;

5 an optical ignition subsystem for generating a plurality of optical pulses,
the optical pulses igniting each fuel/oxidizer mixture such that the chambers
detonate in a desired order; and

an optical transport subsystem for transporting the optical pulses from the
optical ignition subsystem to the chambers.

2. The detonation system of claim 1 wherein the optical ignition
subsystem includes:

an optical energy source for generating optical energy at a predetermined
intensity level;

5 an optical multiplexing device for separating the optical energy such that
the optical energy sequentially detonates the banks and simultaneously
detonates the chambers within each bank; and

an optical interface for optically coupling the energy source to the
multiplexing device.

3. The detonation system of claim 2 wherein the energy source
generates a single pulse of the optical energy, the multiplexing device dividing
the single pulse into a plurality of pulses and routing the pulses to the chambers.

4. The detonation system of claim 2 wherein the energy source generates a plurality of pulses of the optical energy, the multiplexing device routing the pulses to the chambers.

5. The detonation system of claim 2 wherein the energy source is a laser.

6. The detonation system of claim 1 wherein the optical transport subsystem includes a plurality of optical fibers.

7. The detonation system of claim 1 wherein the optical energy drives each fuel/oxidizer mixture into a self-initiating chemical admixture.

8. The detonation system of claim 1 wherein the optical pulses are generated in accordance with a predetermined optical intensity equation.

9. The detonation system of claim 8 wherein the optical intensity equation is

$$I_{cr} = \{[mcE_I(1 + (\omega\tau)^2)]/[2\pi e^2 \tau]\}[g + 1 / \tau_p \log_e(\rho_{cr} / \rho_0)]$$

where ρ_{cr} is the critical electron number for breakdown, τ_p is the laser pulsewidth,

5 m , E , c are the electron constants, ω is the optical field frequency, E_I is the ionization energy of the fuel/oxidizer or oxidizer, τ is the momentum transfer collision time, g is the electron loss rate, and ρ_0 is the "initial" electron density.

10. An optical ignition subsystem for a pulse detonation wave engine
detonation system, ~~the ignition subsystem~~ including:

an optical energy source for generating optical energy at a predetermined
intensity level;

5 an optical multiplexing device for separating the optical energy such that
the optical energy sequentially detonates banks of the detonation system and
simultaneously detonates chambers contained within each bank; and

an optical interface for optically coupling the energy source to the
multiplexing device.

11. The ignition subsystem of claim 10 wherein the energy source
generates a single pulse of the optical energy, the multiplexing device dividing
the single pulse into a plurality of pulses and routing the pulses to the chambers.

12. The detonation system of claim 10 wherein the energy source
generates a plurality of pulses of the optical energy, the multiplexing device
routing the pulses to the chambers.

1 identical 13. The detonation system of claim 10 wherein the energy source
generates a plurality of pulses of the optical energy, the multiplexing device
routing the pulses to the chambers.

14. A method for detonating a pulse detonation wave engine, the method comprising the steps of:

transporting a fuel/oxidizer mixture from a propellant source to a plurality of detonation banks, each detonation bank having a plurality of detonation chambers;

generating a plurality of optical pulses, the optical pulses igniting each fuel/oxidizer mixture such that the chambers detonate in a desired order; and transporting the optical pulses to the chambers.

15. The method of claim 14 further including the steps of:
generating optical energy at a predetermined intensity level; and
separating the optical energy such that the optical energy sequentially detonates the banks and simultaneously detonates the chambers within each bank.

16. The method of claim 15 further including the steps of:
generating a single pulse of the optical energy; and
dividing the single pulse into a plurality of pulses.

17. The method of claim 15 further including the step of generating a plurality of pulses of the optical energy.

18. The method of claim 14 further including the step of driving each fuel/oxidizer mixture into a self-initiating chemical admixture.

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